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THE ROLE OF SELECTED ORGANIZATIONAL VARIABLES IN LEARNING FROM WRITTEN INSTRUCTION

John F. Carter
Carol Carrier

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IN LEARNING FROM WRITTEN INSTRUCTION

John F. Carter
Carol Carrier

Syracuse University
Syracuse, New York 13210

Prepared for

Navy Personnel Research and Development Center
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20. ABSTRACT (Continued)

Using free recall immediately after reading, the first experiment showed very little effect from organizational variables; trainees apparently being able to subjectively organize material even when presented illogically. Three rapid readings of the material rather than a single longer exposure was superior, and, of course, high verbal ability trainees recalled more. High verbal ability trainees were better able to recall the categories into which the textual material fell.

In the second experiment, the organizational factor was increased in strength, trainees either read the passage once or three times but with total time not controlled, and both free and cued recall were measured. Under these conditions, the organizational factor exerted a significant influence on cued recall, but only if the passage were read three times.

Inferences for both educational practice and research are drawn from these findings.

FOREWORD

This research was performed under Exploratory Development Task Area PF55.522.002 (Methodology for Developing/Evaluating Navy Training Programs) and Work Unit Number PF55.522.002.03.30 (Exploratory Investigation and Tests of Innovative Training Procedures for Application in Navy Instructional Programs). This research was initiated in response to the requirement for "improvements in training methodologies, measurement techniques, management and administration, including decision criteria required for their rapid implementation." (GOR 43, Rev. 10/71.)

Dr. Edwin G. Aiken was the technical contract monitor for the Navy Personnel Research and Development Center on this research effort. The basic idea for the research was developed during Dr. John Carter's employment at this Center during the summer of 1973.

F. L. NELSON
Commanding Officer

SUMMARY

Problem

There is an increasing requirement for Navy personnel at all levels to obtain information from written text. If deficiencies are observed in this regard, at least three options are open. Improve the reader, improve the writing, or substitute another medium for the written text. This research sought data on text organizational factors as a basis for improving learning.

Objectives

To investigate organizational variables for their influence on learning from textual materials. To relate the effects of organizational variables to the ability level of the trainees, the type of retention of the information required, and the number of opportunities provided the trainees for processing the text.

Approach

In the first experiment, the logical sequence of sentences and the manner in which ideas were subordinated were varied in a prose passage. In addition, high and low verbal ability trainees either read the passage once or three times, with total time equated.

In the second experiment, the text material was presented in a manner designed to increase the impact of the organizational variables, one versus three presentations of the text was tested with time not equated, and two kinds of cued recall tests were added to the uncued recall test used in the first experiment.

Results

In the first experiment, a superordinate structure factor called an "advanced organizer" aided recall slightly when sentences were logically sequenced, but was slightly detrimental when logical sequencing was low. Three readings were superior to one reading of a comparable duration. As expected, high verbal ability trainees were superior to those of low ability; the difference being associated with superior recall of the organizational structure.

In the second experiment, logical sequencing had a significant positive effect only on cued recall following three exposures.

Several inferences emerge from these results. They are: (1) sophisticated users of the language have a robust capacity for reorganizing materials which have been presented in an unorganized fashion, (2)

Organizational variables have an influence only after fairly extensive exposure to the text, (3) it is highly questionable as to whether the form of conceptual subordination called the "advanced organizer" is of any great value in recall, (4) cued tests of recall may penalize readers who have formed idiosyncratic cognitive structures and (5) repetitious presentation of textual material has an advantage over a single presentation even when length of time is equated.

Recommendations

Research and development should be extended in this area to include: (1) text organizational effects with longer and more complex materials, (2) explicitly training the readers in the use of the text organization, (3) tests of technologies for rapid, repetitious presentation of text, e.g., compressed speech, (4) examination of text organization in the context of longer retention intervals.

E. G. AIKEN
Technical Contract Monitor

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Among the more important recent developments in psychological research has been the emphasis on organizational processes in learning (Cofer, 1965; Mandler, 1967; Melton and Martin, 1972). Investigations within this area have contributed greatly to knowledge of the functioning of memory and the ways in which retention can be facilitated. These findings are important both for the researcher concerned with the basic issues of human learning and memory, and those interested in the interface between psychological theory and educational practice. For, as better understanding is achieved of the operation of storage and retrieval mechanisms with meaningful verbal materials, it should be possible to more adequately design instructional events which facilitate learning and retention. This paper reviews this research and highlights its implications for instruction. Two experiments are reported which provided tests of these implications, and the results are discussed in terms of instructional theory and practice. Finally, suggestions are made for future research in this area.

Basic Organization in Memory Research

There have been three primary paradigms for the study of organization in memory: category clustering, associative clustering and subjective organization. In the first two of these, word lists are presented to the subject which are selected by the experimenter to contain categorical and/or associative relations. In the last, the words are presumed to be unrelated. Following one or more presentation trials, the Ss are asked to "free recall" the lists, that is to recall them in any order they wish. The interesting finding is that rather than recalling them in the temporal order in which they were presented, Ss recall them in ways which can be identified as categorical,

associative or subjective organization. For the purposes of this review categorical and associative clustering will be discussed together since they are often offered as alternative explanations of the same phenomena, and subjective organization will be discussed separately.

Clustering

The study of clustering can be traced to the work of Bousfield and Sedgewick (1944) who observed in a study of sequential associative responses that when Ss were asked to list items in specific categories they often mentioned items according to subcategorizations. For instance, associations to the category "bird" might begin with several birds of prey followed by several domesticated fowl. Not until the early 1950's, however, did Bousfield develop a methodology for studying this phenomenon (Bousfield, 1953). In this experiment randomly presented words from four conceptual categories were clustered at recall into groups consistent with the conceptual categories. This "category clustering," as it has come to be called, was later found to increase over trials (Bousfield and Cohen, 1953) and seemed to be explainable in terms of the superordinate conceptual relationships which linked the words.

A challenge to this explanation occurred, however, when Jenkins and Russell (1952) reported clustering for words which had no superordinate categorical relationships but were associatively related, and Bousfield, Cohen and Whitmarsh (1958) found greater clustering for high- than for low-frequency associates to the category names. An explanation in terms of inter-item associative strength therefore gained support. In addition, Deese (1959) found that inter-item associative strength was highly correlated (.88) with recall.

Subsequent research has shown, as one might suspect, that both associative strength and conceptual relationships are involved in clustering phenomena. Marshall (1967) demonstrated an independent contribution for conceptual relatedness where associative strength was at some point above zero, and Tulving (1968) has argued that it is premature to make such distinctions since the concept of association is one which itself needs explanation rather than serving to explain other phenomena.

Some Parameters

Whether the mechanisms underlying clustering are well understood or not, the phenomena itself has been shown to be reliable, and we will now look at some of the parameters governing its occurrence.

One question which has been of interest is the relationship between the number of categories present in the materials and recall. Tulving (1968) contended that Ss form higher-order memory units during learning and that these are the functional units of recall. Evidence that Ss recall a fixed number of these units comes from several sources. Miller (1956) in his now famous article argued that the span of short-term memory was seven, plus or minus two, chunks. It didn't matter how much information was in a chunk so long as the Ss perceived it as a unit. In Miller's experiments Ss recoded groups of binary digits into units of smaller size, thus increasing their memory capacity. Regardless of the information load of the units, however, Ss could only remember the seven, plus or minus two chunks.

The most extensive work on the matter, however, has been conducted by Mandler and his associates (Mandler, 1967; Mandler & Pearlstone, 1966).¹

¹It should be noted that Mandler's work is a special case of the Subjective Organization paradigm discussed later. It is included here, however, because of its bearing on the "number of categories" issue.

In these studies Ss performed card sorting tasks in which the number of categories was varied. In some cases Ss were free to use as many categories as they liked and in others the number was constrained by E. The important results of these studies was that recall of the words was a linear function of the number of categories used, but only up to seven categories. In general, Ss were able to recall five, plus or minus two, higher-order units with five words per unit. After a category exceeded five elements the probability of recalling an item given recall of the category began to decrease. Mandler extended his interpretation of these findings to argue that Ss code each higher-order unit into a category name which along with other category names could be grouped into still higher units to form an optimum organizational hierarchy of five levels with five units at each level, or 5^5 elements in all.

Bower, Clark, Winzenz and Lesgold (1969) provide some independent support for Mandler's hypothesis. In this study Ss shown properly arranged conceptual hierarchies recalled significantly more than Ss shown scrambled versions of the same hierarchies. Evidently the blocked presentation allowed Ss to store and retrieve the words in a more efficient manner than did the scrambled presentation. Indeed, Ss were reported to have recalled material in a sequential fashion from the most inclusive concepts to the lower level instances, as though they were employing the conceptual relationships as mnemonic cues for recalling successively more specific information. Blocking as a variable has not always proven to be as facilitative as this (Shuell, 1969), but Bower et al used more complexly related materials than previous studies and thus produced a stronger test. Saliency of the conceptual

pattern in the to-be-learned materials is probably the important variable in these studies. A complex pattern is more easily obscured by a random presentation procedure and therefore becomes less salient and useful to Ss. This explanation is further supported by data from Wittrock and Carter (1974).

Another variable of interest has been the effect of cueing on free recall performance. Tulving and Pearlstone (1966) found that giving Ss category names as cues facilitated recall. Additional recall resulted from the recall of more categories, however, not from additional words per category, which were essentially the same for both cued and uncued recall. These results agree with those of Cohen (1966) who showed that once a category was accessible retrieval was constant.

These findings led Tulving and Pearlstone to distinguish between information "availability" and information "accessibility." Information is available if it is stored, but it is accessible only if it can be recalled. It was clear from their results that more was available than was accessible until the retrieval cues were provided. Retrieval cues, however, are only effective if they are stored along with the to-be-recalled items, even if they are high associates of them (Thomson & Tulving, 1970; Tulving & Osler, 1968; Wood, 1967). In other words, verbal cues are effective only to the extent that they are part of a retrieval scheme salient to S at the time learning occurred. This will be an important finding when we consider recall of prose materials as a function of S's awareness of their implicit organization.

Subjective Organization

In the previous section data were reviewed which showed that when S is given material to learn which has a logical conceptual organization, memory for that material is facilitated. But what happens when the material

is not conceptually related? The data suggest that S imposes his own organization upon it. Tulving (1962, 1964) demonstrated that as Ss recall presumably unorganized lists they tended to recall words in the same order over trials even though there was a different random order of presentation for each trial. He termed this phenomenon "subjective organization" (SO). In his initial experiment, Ss were presented a list of unrelated nouns in a different random order over 16 trials. The important finding was that SO increased as recall increased. While this finding is suggestive, the fact that there is a positive correlation between SO and recall does not prove that it facilitates recall. In a subsequent study, however, the evidence is more persuasive. Tulving (1966) gave a nine-word list to two groups. After 12 learning trials on the initial list a second list was learned which was constructed either from 18 totally new words or nine new words and the nine old words. Contrary to frequency theory there was no positive transfer for the second group, and instead these Ss showed negative transfer. Tulving argued that the SO formed on the first list was inappropriate for the expanded list and this interfered with learning.

In another study investigating this, Bower, Lesgold and Tieman (1969) presented 24 unrelated nouns in six groups of four words each. The words were shown for 12 seconds and the Ss were told to form a mental image linking the words. In one condition Ss saw the same word groupings on all four trials. In a second condition the word groupings were changed on each trial by switching two words at a time between the six groups so no two words appeared in the same grouping more than once. Three hypotheses were compared. A frequency theory would predict no differences between the groups since all were seen the same number of times. If free recall is dependent on intralist

associations, however, performance under the second condition should be better than under other conditions since it provides an opportunity for many associations to be formed. Finally, if recall is dependent on stable organizations, the first condition should produce the best performance. The results clearly and persuasively supported the organization hypothesis.

Mandler and Pearlstone (1966) showed that Ss forced to use another S's organizational scheme take longer to achieve a stable organization, but once the organization is formed, recall as many words. In other words, even a second-hand organization is facilitative.

Implications

The studies reviewed above indicate that the learning of meaningful verbal material is an active process, a process that can be facilitated to the extent that the individual utilizes or constructs an organizational scheme during learning which can act as a specific retrieval plan.

The implications of this for educational endeavors are essentially straightforward. Individuals within schools are required to process and utilize increasingly vast quantities of verbal material. Instructional procedures which foster the creation and utilization of retrieval plans are therefore of potentially great importance for improving learning. The formulation of a retrieval plan can be viewed as a function of three variables: 1) the degree of implicit conceptual organization in the materials, 2) the salience of this organization and 3) a subjective variable loosely describable as the amount of effort S is willing to put forth to formulate a plan. Where there is a highly salient organization the formulation

of a retrieval plan should require relatively little effort; where the materials have low organization or it is of low salience greater effort would be needed. Mandler and Pearlstone's (1966) finding that recall was constant following the formation of a stable organizational pattern, even when it was a subjective pattern devised by another S, suggests that recall will be dependent on the existence of a plan but unrelated to the time or effort needed to devise it. Instructional designers could therefore attempt to influence this process in two ways, 1) through the organizational characteristics of the materials and 2) through training of learners in organizational strategies.

The rub, of course, is that it has not often been the case that the findings of laboratory investigations of learning are easily translatable into prescriptions for the teacher or instructional designer. Attention will therefore be focused on research concerned with the effects of organizational variables on learning and memory for materials used in schools or like those used in schools.

Research with Instructional Materials

Research on organizational variables in education contexts has paralleled basic memory research in focusing both the organizational characteristics of the material, and the S's cognitive organizing strategies. The difference lies primarily in the use of materials more similar to those found in the classroom than the word list favored in basic memory research. Research involving manipulations of the organizational characteristics of the materials will be reviewed first.

Manipulation of Organizational Characteristics

In a study involving the retention of factual information Gagne (1969) presented five science facts to fourth and fifth grade children in the form of sentences embedded within a context of other sentences. In each case four context sentences were presented along with the sentence containing the to-be-remembered fact. The context was either superordinate (one of the four context sentences was a topic sentence), coordinate (each of the four context sentences was related to the to-be-remembered item but none were superordinate), or unrelated (all sentences contained facts unrelated to the others). The important finding was that recall was significantly better for facts embedded in a superordinate context, followed by those in a coordinate context, and lastly an unrelated context. In a second study using fourth-grade Ss, Gagne and Wiegand (1970) found that recall was significantly enhanced when the superordinate sentence was presented at the time of recall, for both a superordinate context group and a coordinate context group. This effect parallels the Tulving and Pearlstone (1966) data on cueing and suggests that school learning can be facilitated by providing a basis for constructing a retrieval plan. This is easier when a superordinate sentence is present, although still possible for coordinate sentences if S generates the higher level ideas himself. A context of unrelated sentences makes the formation of a retrieval plan very difficult if not impossible and would therefore result in the poorest recall.

Bruning (1970) prepared a 100-sentence prose passage about a fictitious African nation. The passage was divided into 25 paragraphs with four sentences each. For each paragraph the first sentence was a topic or superordinate sentence and the following three were coordinate sentences

describing related factual information of the form, "Among European nations, Mala trades mostly with Albania." The underlined word represented a response term for a completion item. From the 75 subordinate sentences five were randomly chosen and designated test sentences and were to appear at the end of paragraphs, 1, 7, 13, 19, and 25. Three manipulations of context for these five sentences were made. In one condition, the passage remained in its original form with each test sentence appearing in the paragraph to which it was related. This was called the Relevant Organized Condition (ROC). For the second condition the test sentences remained in their same positions within the passage but the other 95 sentences were scrambled and given randomly determined positions. This was the Relevant Scrambled Condition (RSC). The third manipulation placed the test sentences among unrelated factual information drawn from an almanac. The test sentences again retained their same relative position in the passage. This group was the Irrelevant Scrambled Condition (ISC). An immediate completion test revealed reliably better recall for the ROC and RSC groups than the ISC group, but no differences between the ROC and RSC treatments. Although Bruning's data would seem to present damaging evidence for the position that organization facilitates recall with prose materials, the study actually provided only a minimal opportunity for facilitation to occur. The salience of conceptual organization should primarily operate to facilitate retrieval - through the construction of a retrieval plan-, and to a lesser degree storage. Bruning's recall test was more similar to a paired-associate task than a free recall task. His Ss had a specific stimulus retrieval cue in the form of the available portion of the sentence. Therefore, there was no opportunity

for a retrieval plan to operate in the ROC condition. What is needed to make a fair test of the organization hypothesis is an uncued recall test.

Evidence supporting this hypothesis comes from Kissler and Lloyd (1973). These investigators found significant differences between scrambled and logically presented sentences on a short answer test, but not on a completion test. Put another way, no effect of scrambling was observed where a retrieval mnemonic would not be expected to operate. Scrambling did have an influence when retrieval depended upon the existence of internal rather than external cues.

Frase (1969a) found significant differences in the kind of information which was recalled depending on the way the instructional materials were organized. However, his study involved different task requirements than most. The Ss had to sort through a passage or group of sentences organized either in terms of the names or attributes of the planets in a fictitious solar system and find the name of a planet with certain attributes. The Ss' memory for the names and attributes depended on how the materials were organized. When the material was organized by name, recall of attributes was high but recognition of names was low. When the material was organized according to attributes the reverse was true. In other words, the information which was the basis for the organization was not processed in the same way as was the information not the basis for the organization. However, it must be noted that this was an incidental learning task and Ss weren't trying to remember all the material, only to find a certain planet. The task requirements demanded that in each case different information be held in memory while other information was being sought, depending on the organizational scheme. Following Anderson's (1971) argument, different things were processed

phonologically and semantically in each case. The important finding is that the organization of the instructional materials did have significant effects on what the Ss learned.

In a second study which did require intentional learning Frase (1969b) found significant effects for the way instructional materials were organized. In this study, 48 sentences involving all combinations of the names of six chessmen and eight attributes were written. These were then organized in three ways: by attribute (A), by name (N) or randomly (R). Frase found that either A or N organization resulted in significantly better recall of correct name-attribute relations than R organization. Furthermore, Ss who were given information about the structure of the materials gained a cumulative advantage across study-test recall trials. Similar results have been obtained by Myers, Bezdek and Coulson (1973). However, studies focusing on the effects of name vs. attribute organization have only limited educational significance since there are few parallels to this paradigm in normal instructional contexts.

A number of studies have not found significant effects, however. These are for the most part older but nonetheless bear mentioning. Typically, the paradigm involved adding headings, summaries, outlines and the like to actual instructional materials. Robinson and Hall (1941) in their third experiment added paragraph headings to a 3,000-word Russian history passage and a 4,500-word Canadian history passage. College students read one passage with headings and one without headings in counterbalanced order and then answered questions of an unspecified sort on the material they had read. There were no significant differences either for reading rate or test performance

in fact the groups differed by only one half a percentage point.

Christensen and Stordahl (1955) employed a 3x3x2x2 between subject factorial design to investigate the effects of headings, summaries, outlines and underlining. No significant effects were reported.

In a more recent study, Lee (1965) investigated the role of prose structure in learning. In this study, prose passages concerning naval regulations were either presented in unaltered form, with scrambled paragraphs or in proper order with the addition of a supra-paragraph structure involving summaries, headings, transitional paragraphs, etc. Lee found significant facilitation on short essay questions covering main ideas in the passage for Ss reading the elaborated passage. However, since this was the specific material covered in the elaborations, it is possible to explain these findings simply on the basis of greater exposure for this group. Failure to control for the direct instructive effects of the organizational elaboration precludes generalizing from this study.

A possible explanation for the negative findings in this area is that often there was nothing in the procedures which required the processing of the organizing variables along with the text. As Rothkopf (1963) has pointed out, and more recently Anderson (1970), the nominal stimuli in an instructional context must become the functional stimuli before learning occurs. Merely presenting organizational stimuli does not ensure they will aid the S to construct a retrieval plan. Furthermore, as has already been discussed, a retrieval plan cannot be effective unless it is stored along with the to-be-recalled material. In other words, merely embellishing instruction with organizational aids is not enough, the S must attend to these aids and learn them as part of the instruction.

Another hypothesis is that organizational elaboration in the form of headings, underlining and the like is superfluous for the materials employed in these studies. The Ss may have spontaneously generated an equivalent structural elaboration in the same way that occurs for the category names of instances which are high-frequency associates of the categories. At some point, therefore, further elaboration may not add anything to the salience of the existing organizational pattern.

Unfortunately, available data do not distinguish between these hypotheses. The evidence from the more recent investigations is suggestive, but many questions remain unanswered with regard to the effects of manipulating the organizational characteristics of instructional materials.

Subjective Organization with Instructional Materials

Attention will be focused in this section on the attempts to influence the organizational activities of the S as he studies the instructional material, his "subjective organization" of it. There have been two different approaches to this question. The first is represented by a fifty-year-old tradition in which instructions to employ different organizational strategies to enhance learning have been investigated. For example, instructions have been given to summarize, outline, underline and the like. In this context, "organization" involved some strategy for abstracting or identifying the important parts of an instructional passage.

The second approach is that taken by Ausubel and his associates involving what he calls "advance organizers" (Ausubel, 1960). According to Ausubel's theory, "cognitive structure is hierarchically organized in terms of highly inclusive concepts under which are subsumed less inclusive

subconcepts and informational data" (1960). What this implies is that the incorporation of new material into the cognitive structure depends partly on the existence of these more general concepts under which it can be subsumed. "Advance organizers" were therefore defined as material "at a much higher level of abstraction, generality, and inclusiveness" than the material to be learned, thus providing the relevant subsumer. We will look first to Ausubel's work and then return to the organizational strategy research.

Advance Organizers. In the initial experiment testing this theory, Ausubel (1960) formed three groups: an experimental group which read an advance organizer before reading the instructional passage, a control group which read non-organizing material first, and a second control which read only the advance organizer. The experimental group performed significantly better on the test of the content of the instructional passage than the non-organizer control, while the advance-organizer-only control performed only slightly better than chance. This latter control group is necessary, of course, to defend against the criticism that the facilitative effects of advance organizers are merely due to repetition of the material to be learner.

In a followup study, Ausubel and Fitzgerald (1961) argued that advance organizers function in two ways. The first is to provide "ideational scaffolding" upon which to hang new and unfamiliar material. The second is to increase the discriminability of the new material from previously learned concepts. In this experiment there were two experimental and two control groups. Both experimental groups and one control read a passage on Buddhism which was presumed to be related to concepts of Christianity already possessed

by the subjects. One experimental group (C-E) read a "comparative organizer" which delineated the similarities and differences between Buddhism and Christianity. A second experimental group (E-E) read an "expository organizer" which presented Buddhist doctrines at a high level of abstraction, generality and inclusiveness. One control group (H-C) read a non-organizing introduction about the history of Buddhism while the second control group (T-C) merely read the comparative organizer and took the criterion test. On the three-day retention test the group receiving the comparative organizer scored significantly higher than both the E-E and H-C groups which did not differ. (The test control data were not included in this analysis.) On the ten-day retention test, both experimental groups were superior to the Historical Control. However, since the test control group (T-C) scored nearly twice the chance performance on the test, and significantly greater than a naive group which took only the test without having seen either the organizer or the passage, little confidence can be placed in these data. It seems difficult to conclude other than that the comparative organizer had a direct instructive effect which confounds any interpretation of the effects of the advance organizer on learning from the instructional passage itself. Unfortunately, no control was included for the expository organizer so it is impossible to evaluate the performance of this group.

Although the inclusion of a control to test the instructive effects of an advance organizer is clearly necessary, and has already shown the results of one study to be equivocal, in no other study of the effects of advance organizers has it been used. Regardless of any other redeeming virtue of Ausubel's theory, such as its intuitive appeal, this fact alone

precludes there having been a proper test of its validity, since the first two studies can scarcely be said to be conclusive. Nevertheless, in the interest of completeness, the subsequent research on the topic will be reviewed briefly.

In the next experiment in the series, Ausubel and Fitzgerald (1962) attempted to show that advance organizers could facilitate the learning of entirely new and unfamiliar material for which, it was presumed, no prior cognitive structure was in existence. Using materials on the endocrinology of pubescence preceded by an expository organizer for the experimental group and a non-organizer passage for the control, no significant facilitation from the organizer was found. A significant facilitation for experimental Ss in the lowest of three verbal ability groups was reported, however.

Ausubel and Youssef (1963) had Ss read two passages, each preceded by an advance organizer. The two passages were on Buddhism and Zen Buddhism, respectively; and the organizers compared Buddhism to Christianity and Buddhism to Zen Buddhism, respectively. They found facilitation from the first organizing passage but not from the second. Research by subsequent investigators has been equally contradictory. Grotelueschen and Sjogren (1968) used organizers varying in generality prior to the learning of the base four number system. The facilitative effects of the advance organizer varied directly with the degree of generality. Schulz (1966) presented advanced organizers before two elementary school science sequences. His results were "inconclusive regarding the general role of advance organizers" but were suggestive in that they were helpful to students who lacked the

ability to organize the material independently. Allen (1970) employed both advance organizers and questions inserted in the text to enhance learning but found no overall facilitative effect for the advance organizers. A number of significant interactions between advance organizers and inserted questions were reported; and there was evidence that advance organizers facilitated the performance of low verbal ability Ss. But, the analysis procedures can be called into question, since rather than performing the appropriate factorial analysis, a series of one-way ANOVAs with post-hoc analyses were run.

Finally, Scandura and Wells (1967) found a facilitative effect for an advance organizer used with mathematics materials. The advance organizers used were specific descriptions of concrete mathematical models, however, and therefore, less general than the material to follow; the opposite of Ausubel's (1960) definition of an advance organizer. Thus, even the definition of an advance organizer is clouded by this study. Indeed, Wittrock (1963) using Ausubel's Buddhism passage and instructional sets to compare Buddhism to Christianity, contrast Buddhism to Christianity or compare and contrast Buddhism to Christianity; found facilitative effects for the instructional sets involving the instruction to "contrast" of the same magnitude as those of Ausubel and Fitzgerald (1961).

Clearly, no definite conclusions can be drawn from these studies. The failure to control for the direct instructive effects of the advance organizer is a serious flaw. Even ignoring this, however, the evidence does not clearly support the contention that advance organizers are facilitative. The literature on organizational strategies will be examined next but it fairs little better than the advance organizer research.

Organizational Strategies. Germane (1921a) compared the effects of reading and rereading a passage for 30 minutes with reading and summarizing the passage for the same length of time for grade six through eight. Summarizing was defined as writing down the main points of the article. The consistent result was for the rereading group to be slightly superior in performance on both an immediate and delay test and on both "reason" and "memory" questions for every grade level. The reason questions were stated to require "considerable thought and organization" while the memory questions apparently tested verbatim recall. No statistical tests were conducted, however, so it is impossible to know if these were significant differences.

In a second study on the same topic Germane (1921b) modified the summarizing procedure used in the above experiment. Instead of merely telling the experimental Ss to "summarize," they were told to read the article once, turn it over and attempt to construct a summary of what they read, and then to correct the summary for points missed. The control group was again told to read and reread as often as they could during the time given. As in the first study, the rereading group was superior for every grade level.

In a very complex and extensive naturalistic study Beauchamp (1923) compared several methods of study employed by junior high school students. The study extended over a three month period during which different study methods were employed by the experimental group and compared with a control which followed a study procedure best described as "careful reading." The instructional materials were four units of a junior high science curriculum. The control group used the same study method (careful reading)

throughout, while the experimental group employed the following procedures on succeeding units: I) careful reading, II) outlining of paragraphs, III) posing of questions about the text materials, and IV) creation of an outline of the entire unit. Although no statistical tests were reported, tertile scores would indicate a likely significant effect in favor of the experimental group for units II, III and IV on essay tests requiring recall of the material studied.

Beauchamp's findings are suggestive that procedures which require the S to organize the instructional materials himself can facilitate learning. It should be noted, furthermore, that these results were obtained in a naturalistic setting during the regular course work of the student over a period of three months. This is the very setting where many laboratory findings have gone awry and where differences must be shown to occur if learning research is to have generality for educational contexts.

However, other studies involving a variety of organizational variables such as outlining, note taking, precise writing, underlining, summarizing and the like (Arnold, 1942; Matthews, 1938; Newlun, 1930; Stordahl and Christensen, 1956) have failed to show consistent results in favor of the organizing activity.

Although the generally contradictory nature of the findings in this area are hardly comforting for the position that organizational variables are important for learning of classroom materials, it can fairly be said that the methodological flaws which pervade most of this literature have precluded a reasonable test of the hypothesis. On the other hand, if the findings of the basic research on organization in memory have any generality for instruction, that generality remains to be shown in a convincing manner. The superficial conclusion that the presence or absence of

organizational variables doesn't make any difference in instructional contexts is not only counter-intuitive but denies the relevance of a broad range of psychological research for educational concerns. A more reasonable conclusion is that the research to date has not provided the kind of systematic analysis and investigation which is needed. The fact that most of the instructional research in question occurred before the relevant psychological research supports this conclusion. It is doubtful that merely adding headings and the like or telling Ss to "summarize" without some assurance that the aids are being processed or the instructions carried out is meeting the conditions necessary for such things to become important.

The Present Research

In the preceding sections, laboratory studies of organizational processes in memory were reviewed and several implications of that literature for learning from written instructional materials were developed. A review of research investigating the effects of organizational factors with instructional materials, however, failed to give convincing evidence of the validity of these implications for educational settings. Instead, a rather confusing picture of contradictory findings emerged which were difficult to interpret because of varying contexts, procedures and frequent methodological inadequacies. With this in mind, the following experiments were carried out in an attempt to clarify the effects of several organizational variables on learning from written instructional materials.

Experiment I

It was argued in the review of literature that one of the factors effecting development of a retrieval scheme useful in recall, was the saliency of the conceptual organization of the to-be-recalled material. Evidence for this comes from Bower, et al (1969) and Wittrock and Carter (1974), however, these studies used word lists rather than prose materials.

Operationally, a prose passage with scrambled sentences would represent a low salience condition which should produce decreased recall compared to a condition in which sentences were presented in a logical sequence. However, Carter (1972) failed to find such an effect for Ss reading a 1500 word prose passage with reading rate uncontrolled except for total time available. It may be that in a free reading situation Ss are able to sufficiently "unscramble" the materials to obviate the effects of low salience. The present study attempted to more closely control reading rate by presenting sentences one at a time.

The second variable of interest in this study was the placement of sentences revealing the higher-level conceptual structure of the passage. The passage utilized in this research was written so as to be represented by an elaborate conceptual hierarchy. In other words, the passage contained ideas which were more general and inclusive than other ideas in the passage, and in fact, were describable in terms of class inclusion relationships. Figure 1 shows a simple passage structure with such a hierarchical organization. The nodes A, B₁ and B₂ represent sentences introducing a superordinate and two subordinate concepts respectively, and the C₁ through C₄ sentences, the instances subordinate to the conceptual classes delimited by the A and B level sentences.

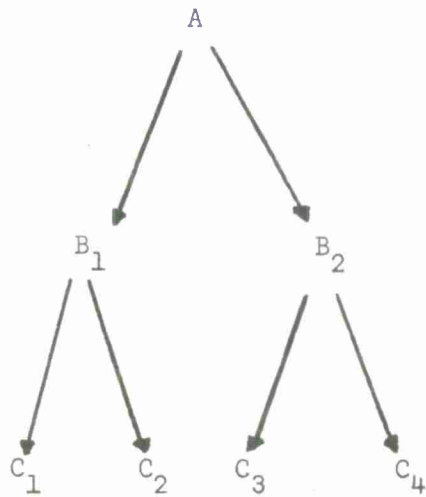


Figure 1. Simple hierarchical passage where each letter refers to a sentence.

A passage structured in such a way permits a test of the theory proposed by Ausubel (1960) regarding the effects of advance organizers. Ausubel proposed that the reading of material at a "higher level of generality and inclusiveness" before encountering an instructional passage would enhance learning and retention. While the evidence for this theory is inconclusive it does tend to support Ausubel. One way of conceptualizing the function of advance organizers in the present context is that they facilitate the development of a retrieval mnemonic for the material to be learned. In this sense, the higher level structure of the passage described above represents a true advance organizer. The problem now becomes to determine if such an organizing framework facilitates learning when presented in advance of lower level ideas, as Ausubel's theory would suggest, versus when presented within the context of lower level ideas. This difference can be illuminated with reference to Figure 1. If sentences A, B₁ and B₂ are read before sentences C₁ through C₄ are encountered, then the superordinate structure of the passage can be said to constitute an "advance organizer" for the ideas contained in the level-C sentences. If, on the other hand, the sentences are read in the sequence that follows, the superordinate structure would not serve as an advance organizer: A, B₁, C₁, C₂, B₂, C₃, C₄, etc. The difference between these two presentation formats increases, of course, as the conceptual hierarchy for the passage becomes more complex.

This design permits a better test of the advance organizer hypothesis than previous research, because it allows variation in the placement of presumably organizing concepts while holding content constant, and thus avoids the methodological problems pointed out previously. Figure 2 illustrates the sequences of sentences which would result from the

Superordinate Structure

Organizational

Saliency

Mixed Placement

Pre-Placement

Hi

A, B₁, C₁, C₂, B₂, C₃, C₄

A, B₁, B₂, C₁, C₂, C₃, C₄

Lo

C₄, B₂, C₁, A, C₃, B₁, C₂

B₂, A, B₁, C₄, C₁, C₃, C₂

Figure 2. Sentence sequences in treatment condition.

orthogonal combination of the Superordinate Structure factor (Pre-Placement vs. Mixed Placement) and the Organizational Salience factor (Hi vs. Lo).

The third variable was Exposure Mode (Single vs. Triple). There was interest in observing whether reading the materials through three separate times (Triple Exposure Condition) was facilitative over reading the materials through only once (Single Exposure Condition), where total exposure time was equated. Multiple exposures, even when the total time involved is no greater than for a single exposure, should facilitate the formation of a general retrieval scheme, since S has knowledge of the total organizational structure of the passage on exposures subsequent to the first. Those in the Single Exposure (SE) condition lack this multiple opportunity for encoding and elaboration of the superordinate conceptual structure of the passage. Thus, the Triple Exposure (TE) condition is predicted to produce better recall than the Single Exposure condition. Furthermore, the Low Organizational Salience (LOS) group should be benefitted to a relatively greater degree under the TE condition than the High Organizational Salience (HOS) group, since the exposure to scrambled materials makes the development of a conceptual framework for retrieval more difficult than exposure to logically sequenced materials.

Finally, two levels of verbal ability were included to study its relationship to the above factors. No particular hypotheses were generated with respect to this factor, except the expectation that high ability Ss would perform better than low ability Ss. Any interactions with other factors which do occur, however, would have significance within the Attribute X Treatment Interaction (ATI) context.

Method

Design and Subjects

The design for the study was a 2x2x2x2 factorial with four between subject factors. These were Organizational Salience (Hi vs. Lo), Superordinate Structure (Pre vs. Mixed Placement), Exposure Format (Single vs. Triple) and Verbal Ability (Hi vs. Lo). The first three of these were operationalized through the presentation of the prose passage, and Verbal Ability by blocking on scores from the Wide Range Vocabulary Test (French, Ekstrom & Price, 1967).

One hundred and forty-four Syracuse University freshmen and sophomores served as paid volunteers for the study.

Materials

Passage. A passage of 1067 words was written giving an anthropological description of the "Himoots," a fictional South American tribe, and containing the implicit conceptual hierarchy described in Figure 3. In constructing this passage, Lee's (1965) use of the term hierarchy was operationalized. In other words, the passage contained ideas which were more general and encompassing than others, but the lower level ideas were meaningful in themselves. They were not prerequisite to understanding the higher level ones, except to the extent that they divide the more general topics into subtopics and instances. For a passage to have this kind of organization, there must be at least two subtopics below the general topic. However, the basic model can be expanded indefinitely by dividing and redividing the material into increasingly more specific segments. The complexity of a passage would therefore be a positive function of the number of levels and the number of nodes at each level.

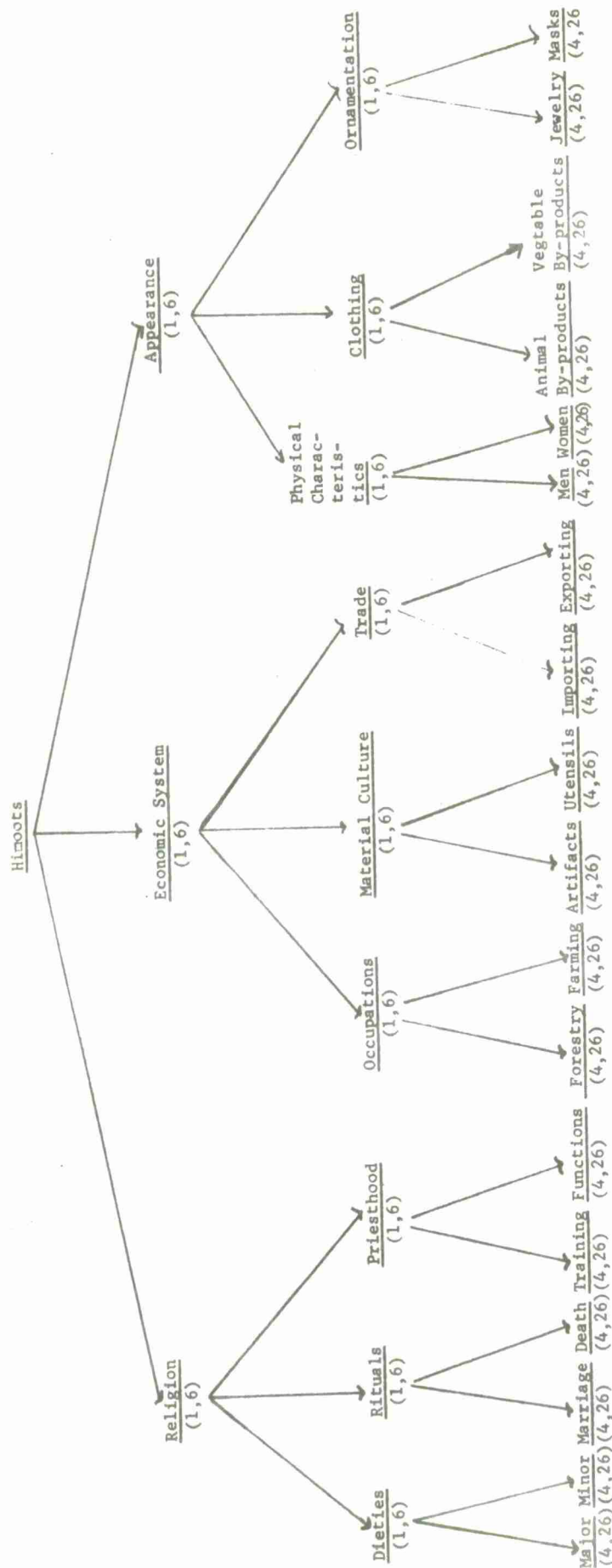


Figure 3. Himoots conceptual hierarchy.

Information about the Himoots (the level A term) was divided into three major topics: Religion, Economic System, and Appearance (the level B terms). Each major topic (level B) was further divided into three subtopics (level C), and each subtopic redivided into two further subtopics (level D). Therefore, the number of nodes in each level of the hierarchy was equal across all categories. That is, B=1, C=3, and D=2 in the hierarchical substructure of every major topic. Figure 3 shows the conceptual outline for the entire passage.

The number of sentences comprising each node at each level of each category was also equated. The first number in the parentheses in Figure 3 indicates the number of sentences comprising each segment of the hierarchy. It may be seen that number of sentences at each level was constant across categories, yielding a total of 84 sentences. Although sentence length was not equated, the number of words among categories was approximately the same. Each sentence was divided into "information units" (IU's). An "information unit" was operationally defined as any word or phrase which conveyed a single fact. Nouns were classified as information units because they convey pieces of data which can be categorized as facts. Adjectives and adverbs were also scored as individual information units because they serve as modifiers contributing additional knowledge to other information units. Verbs were considered as independent information units only when they were not associated with a direct object, or where they stated a fact which was true and meaningful in the absence of the object. For instance, this is how one sentence was scored to yield five IU's: ¹ "(In the [marriage] ² ritual), ³ (the couple) ⁴ (sits) ⁵ (on the ground))." In this instance, "sits" was assigned a separate IU since it conveys a fact which is independent of the

object. The verb in the following sentence, however, was scored
1 2
differently: (Priests) (try to maintain peace). In this case, the phrase
"Priests try" would be meaningless without the object.

The number of information units comprising each node in the conceptual hierarchy at each level of each category was equated. In Figure 3, the second number at each node represents the number of information units comprising each segment of the hierarchy. It may be seen that information units were also constant across categories.

It must be noted, at this point, that decisions regarding the definition of IU's were operational in nature and were not meant to represent an ideal linquiste analysis of the passage. This procedure was carried out in order to produce a reliable procedure for scoring the Ss' recall protocols. A great many subjective judgments were made in arriving at a list of IU's, however evidence exists that once such a list is obtained independent scorers are able to use it to score the passage with a high degree of inter-rater reliability (Carter 1972).

One version of the passage was produced to correspond to each passage structure implied by Figure 2. This was done by sequencing the sentences according to the requirements of the individual treatments. The four resulting versions were as follows:

Lo Saliency - Mixed Placement: Sentences were randomly
ordered throughout the passage.

Lo Saliency - Pre-Placement: All higher level sentences
(A, B and C) were presented before any D-level sentences
were shown, but within these two sections sentences were
in random order.

Hi Saliency - Mixed Placement: Sentences appeared in what constitutes a normal prose format with superordinate sentences appearing immediately before the relevant subordinate sentences.

Hi Saliency - Pre-Placement: All higher level sentences (A, B, and C) were presented before any D-level sentence but within these two sections all sentences were in a logical order.

For all versions, each sentence was typed on an individual 2 3/4 x 8 1/2 inch sheet of paper. The Exposure Format factor was operationalized by presenting a single sentence three times in a row (Single Exposure Condition) or by presenting all 84 sentences once, followed by two additional sets of 84 sentences (Triple Exposure Condition). The 252 individual sheets (84 sentences x 3 replications) were collated into booklets for presentation. There were eight different booklets, one for each treatment.

Test. An uncued test using instructions analogous to those in the free recall paradigm was constructed. The Ss were told to "recall as many facts as possible" with the constraint that they write the information in complete sentences. This constraint was imposed to preclude recall in outline form, which would make scoring very difficult.

Procedure

The study was run in groups ranging in size from 6-18 Ss. Subjects were assigned to conditions by distribution of randomly arranged experimental packets containing all materials for the study.

After being seated Ss took the Wide Range Vocabulary Test. This was timed at 10 minutes. At the end of this period Ss read the instructions

for the particular treatment group to which they had been assigned, and then when signalled to begin read through the booklet, one sentence at a time at a four and one half second rate paced by clicks from a tape recorder. This yielded an average reading rate of 170 words per minute for the entire passage, although for individual sentences this ranged from 93 words per minute to 307 words per minute due to differing lengths. A four-minute interpolated period followed during which Ss took a visual abstract reasoning test. This activity was inserted to prevent recall from the short-term memory rehearsal buffer. Following this period, Ss were given unlimited time to free recall what they could remember from the passage.

Results

Scoring

The tests were scored using a key which listed each of the 540 information units. An item was scored correct if it was judged to have the same meaning as any of these units.

Blocking on verbal ability was achieved by dividing the distribution of scores on the Wide Range Vocabulary Test at the median.

Recall

Table 1 presents the mean recall of information units for the various treatments. Because of the unequal numbers of Ss in cells resulting from the post-hoc blocking procedure, an unweighted means Anova was run on the total number of information units recalled. Significant effects were found for Exposure Mode $F(1, 128) = 6.5748, p < .05$; Verbal Ability $F(1, 128) = 7.4415, p < .01$ and the Organizational Salience X Superordinate Structure interaction $F(1, 128) = 4.0497, p < .05$.

Table 1
Mean Recall of Information Units

Superordinate Structure	Exposure Mode	Organizational Salience	<u>Verbal Ability</u>		Total
			High	Low	
Mixed	Single	High	128.70	104.13	116.41
		Low	125.78	133.11	129.44
	Triple	High	176.67	136.17	156.42
		Low	189.25	135.50	162.37
Pre	Single	High	135.70	139.63	137.66
		Low	149.67	101.22	125.45
	Triple	High	159.08	156.67	157.88
		Low	134.38	105.90	120.14
Total	Single	High	132.30	121.88	127.04
		Low	137.73	117.17	127.45
	Triple	High	167.88	146.42	157.15
		Low	161.82	120.70	141.26

A simple main effects analysis of the Organizational Saliency X Superordinate Structure interaction indicated that the HOS condition produced reliably greater recall for the Pre-Placement condition, while differences for the Mixed Placement condition were not reliable. Also, the Pre-Placement condition resulted in significantly lower recall for the LOS materials, while there were no differences for the HOS materials as a function of the placement of the superordinate structure.

In order to illuminate the processes mediating recall, analyses were also run on conceptual clustering, the number of categories recalled, and the number of information units recalled per category. These are reported in the following sections.

Clustering

The recall protocols were scored for the degree of conceptual clustering for sentences recalled within the eighteen level-D categories (see Figure 3), using the adjusted ratio of clustering (ARC) formula (Roemer, Thompson and Brown, 1971). This formula yields a score of from -1.00 to +1.00 where "0" means chance clustering and +1.00 means perfect clustering. The dependent measure was clustering at the sentence level rather than at the information unit level since inherent categorical clustering at the information unit level for the LOS condition was greater than chance. This could not have been avoided except by scrambling the passage at the IU level rather than at sentence level, or by restricting every sentence to the statement of a single information unit. Either of these procedures would have resulted in a passage quite unlike normal prose.

Since proportional scores are not normally distributed, the ARC data were subjected to an arc sine transformation prior to analysis. The HOS

condition produced significantly greater clustering at recall (+.81) than did the LOS condition (+.67) $F(1, 128) = 10.8592, p < .01$. It's interesting to note, however, that the input clustering index for the HOS passage was +1.00 while for the LOS passage it was .00. Put another way, output clustering decreased relative to input for the HOS condition and increased relative to input for the LOS condition. No other effects were reliable in the clustering analysis.

Recall of Categories and Information Units/Category

Previous research has indicated that recall differences should be a function of number of categories recalled rather than the number of instances (in this study IU's) recalled per category (Cohen, 1966; Tulving & Pearlstone, 1966). The number of categories recalled and the number of information units per category were scored for each S and submitted to a 2x2x2x2 unweighted means Anova with the same factors as before.

The analysis on number of categories recalled revealed significance only for the Verbal Ability factor $F(1, 128) = 5.3143, p < .05$. High verbal ability Ss recalled an average of 14.68 categories while low verbal ability Ss recalled an average of 13.41 categories (out of 18 possible categories).

In the analysis for IU's/category the Triple Exposure Condition resulted in reliably greater recall of IU's per-category (9.26) than did the Single Exposure Condition (8.02) $F(1, 128) = 8.4906, p < .01$. In addition, there was a significant Organizational Salience X Superordinate Structure interaction $F(1, 128) = 4.7043, p < .05$. The means for this interaction are presented in Table 2. A simple main effects analysis indicated significantly greater recall for the HOS materials in the Pre-Placement treatment $F(1, 128) = 7.6111, p < .01$. No other effects were reliable $p < .05$.

Table 2

Mean Information Units/Category Recalled

<u>Superordinate Structure</u>	<u>Organizational Salience</u>	
	<u>High</u>	<u>Low</u>
Pre-Placement	9.36	7.70
Mixed Placement	8.66	8.84

Discussion

The central question which this study was designed to answer was the influence of various organizational structures of a prose passage on learning and retention. A main effect for Organizational Saliency was predicted but failed to occur, even given the strong test that the free recall measure should provide. Two possible explanations of this are that 1) Ss in the LOS condition were able to discover and utilize the organizational structure to a greater degree than expected, or 2) Ss in the HOS condition failed to use the structure to their advantage. The clustering data shed some light on this in that even though the HOS condition resulted in significantly more clustering than the LOS condition, the LOS group exhibited a high degree of clustering relative to the chance level inherent in the materials at input. Therefore, the first hypothesis seems most reasonable. Evidently, the capacity of Ss to "unscramble" a randomly presented though highly inherently organized passage is substantial. It should further be noted that the high degree of clustering observed in the LOS condition occurred despite the fact that the ARC scores were computed using E defined categories and any idiosyncratic organization of the passage would have tended to lower these scores.

The Superordinate Structure factor also failed to influence recall as a main effect as predicted from the theory advanced by Ausubel (1960). It did enter into a significant disordinal interaction, however, with the Organizational Saliency factor. This indicates that while an advance organizer of the sort employed in this study may offer a slight advantage when the materials are logically organized, it produces the opposite effect for materials which are not sequenced logically.

In order for the superordinate structure to act as an advance organizer, Ss in the Pre-Placement condition would have to maintain it in memory as they read the lower level sentences, while at the same time trying to associate each new input with the appropriate category. The Ss reading the logically organized materials would have an easier time with this since category shifts among sentences were at a minimum, and all sentences from a particular category appeared together. This would facilitate the generation of the category when it could not be remembered.

In the Mixed Placement Condition the memory load for superordinate structure would be lower since it was being unfolded gradually rather than all at once. However, it is not clear why the LOS condition would be higher than the HOS condition. Perhaps this condition established a problem solving set which influenced mathemagenic behavior (Rothkopf, 1965) in a positive way. Subjects encountering random sentences might begin to infer a categorical structure which would be confirmed upon encountering a superordinate sentence. This could induce more meaningful processing for these Ss.

It had also been predicted that three rapid readings of the passage would produce greater learning than a single, slower reading. The basis for that prediction was that multiple exposures would promote greater discovery and utilization of the superordinate structure of the passage as a retrieval scheme. Although the data supported the prediction, there appears to be a better explanation for the effect than the rationale offered originally. If multiple exposures facilitated the development of a retrieval scheme based on the conceptual structure of the passage, then this should have been accompanied by greater clustering. There was no evidence of increased clustering as a function

of exposure mode. Furthermore, while a superordinate retrieval scheme could facilitate total recall through increasing the number of categories accessible to the S, there is no reason to expect that it would increase the amount of information recalled within a category. Since the differences in recall were attributable to within-category recall, the retrieval scheme hypothesis lacks support.

An alternative hypothesis which receives support from the data is that the mathemagenic processes of the study may have been different in these conditions. The greater number of IU's per category recalled in the Triple Exposure Condition are suggestive of encoding rather than retrieval differences. Since Ss in the Single Exposure Condition knew that they would see the same sentence on three consecutive pages of text, it is possible that they failed to concentrate attention for the full time available to them. The Ss in the Triple Exposure condition were always being confronted by either a new sentence or one which had not been seen for some time. Although Single Exposure Ss were told to use the time to relate what they were reading to previous sentences, the predictability of the sequence may have led to negative mathemagenic behaviors on their part.

These data suggest that procedures which require several rapid readings of a prose passage may be facilitating over procedures requiring a single, though longer, exposure.

The significant effect on recall for the verbal ability factor is not surprising, and since it did not interact with any other factor is of little consequence. However, data from the other analyses shed light on how verbal ability effects free recall of complex prose materials. First, there were no clustering differences between high and low ability Ss. Also, the recall

differences were attributable to the number of categories recalled rather than to recall within a category. This suggests that high verbal ability Ss are better able to utilize the superordinate structure for retrieval of categories, but recall the same amount of within-category information as low ability Ss. In other words, they can recall more conceptual chunks (Miller, 1965) but not richer chunks. If this is the case, then low ability Ss should be helped by external cueing more than high ability Ss.

Experiment II

The second experiment was conducted to investigate the effects of several additional organizational variables. The means for the Organizational Salience variable in Experiment I were in the predicted direction, however, not significantly so. In that study, sentences were presented one at a time at a 4 1/2 second rate. Although, this procedure was instituted to pace and control exposure to the materials, it is possible that this procedure was sufficiently different from a normal reading pattern that it interfered with processing of the materials, and thus obscured the effects of Organizational Salience. In this study a compromise was struck between a free reading and sentence by sentence presentation procedure. Sentences in the HOS condition were presented in groups formed by the clusters in the "C" level of the passage hierarchy (see Figure 3). This increased the organizational salience for the HOS condition compared to that in Experiment I. In the LOS condition sentences were again presented in scrambled order, only in clusters of the same size as those in the HOS condition.

A second manipulation involved the number of exposures to the passage. In Experiment I all Ss saw the passage three times, with two different

exposure formats. In this study, Ss saw the passage either one or three times. This was done to study changes in organizational patterns as a function of number of exposures.

Finally, three sorts of cueing were studied. The most sensitive test for the effects of organizational variables should be a free recall measure, the least sensitive a completion test or other highly cued format. In this study the test formats were uncued free recall, cued recall (higher order categories were cued), and completion. The effects of organization were hypothesized to diminish as amount of cueing increased.

Method

Design and Subjects

Recall scores entered into a 2x2x2 factorial design with three between-subject factors: Organizational Salience (Hi vs. Lo), Exposures (1 vs. 3) and Cueing (Cued vs. Uncued). Scores on the completion test were treated as a separate dependent variable since the total possible score for the completion test was different than for the Cued and Uncued recall tests. These entered into a 2x2 between-subject design with the same factors as above except for Cueing.

Eighty-four Syracuse University undergraduate students served as paid volunteers for the study.

Materials

Passage. The passage was the same one used in Experiment I, and outlined in Figure 3. It was presented in two versions corresponding to the Mixed Condition from Experiment I. Thus, there was a logically sequenced passage with the superordinate conceptual structure gradually presented before relevant

subsections (High Organizational Salience version), and a completely random (Low Organizational Salience) version.

The HOS passage was presented on nine 5 1/2 x 8 1/2 pages. The first page of each three-page sequence presented a B level sentence and the nine C and D level sentences diverging along the first branch of the conceptual hierarchy (see Figure 3). The succeeding two pages contained the nine sentences from the other two branches at the C level. This pattern was repeated a total of three times, once for each B level section. Thus, the entire passage was presented on nine pages containing either ten or nine sentences each. The LOS passage was presented in the same way except that the sentences on each page were determined randomly.

Tests

There were three tests used in the study. The Uncued test was a simple free recall measure employing the instruction to "Recall as many facts as possible from the Himoot passage." This was the same as used in Experiment I. The Cued test was similar except that for each of the C level categories there was an instruction to "Recall as many facts as you can about the Himoots' (category name).\" For instance, "Recall as many facts as you can about the Himoots' deities."

For the completion test the 84 sentences from the passage were presented verbatim with one or more words deleted. Subjects were asked to fill in the missing word, or words.

Procedures

The study was run in groups ranging in size from 5-10. Subjects were assigned to conditions by distribution of randomly arranged experimental

packets containing all materials for the study. The One and Three Exposure sessions were conducted separately, since operationally there was no way to mix them. All other conditions were intermixed within each experimental session.

After reading the instructions for their particular treatment group, Ss read the Himoot passage one page at a time at the equivalent of five seconds per sentence (50 seconds for a ten-sentence page and 45 seconds for a nine sentence page). This yielded an average reading rate of 152 WPM.

After reading the entire passage either once or three times, depending on the Exposure group involved, there was a four minute interpolated period during which Ss performed a visual abstract reasoning task. This activity was intended to prevent recall from the short term rehearsal buffer. Following this, Ss were given unlimited time to complete one of the three tests.

Results

Scoring

The Cued and Uncued recall tests were scored using a key which listed each of the 540 information units. An item was correct if it was judged to have the same meaning as any of these units. The completion test was also scored from a key, with any semantically equivalent response judged acceptable.

Cued vs. Uncued Recall

Table 3 presents the mean recall of information units for the Cued and Uncued tests. The HOS condition produced greater mean recall (152 IU's) than did the LOS condition (121.28 IU's) $F(1, 48) = 6.0241, p < .05$. Exposures also produced a significant main effect $F(1, 48) = 24.3473, p < .01$.

Table 3
Mean Cued and Uncued Recall

Exposure	Test	<u>Organizational Salience</u>		Total
		High	Low	
1	Uncued	98.85	110.29	104.57
	Cued	113.86	92.57	104.71
	Total	106.35	101.43	
3	Uncued	190.42	167.43	178.92
	Cued	219.71	114.86	167.28
	Total	205.06	141.14	
Total	Uncued	144.63	138.86	
	Cued	166.78	103.71	

These main effects were qualified by a significant Organizational Salience x Exposures interaction $F(1, 48) = 4.4228$ $p < .05$ and a significant Organizational Salience x Cueing interaction $F(1, 48) = 4.1695$, $p < .05$. No other effects were reliable $p > .05$.

Simple main effects analyses were conducted for the two significant interactions. For the Organizational Salience x Exposures interaction, the HOS condition resulted in greater recall only for the Three Exposures treatment $F(1, 48) = 10.3158$, $p < .01$, there was significant improvement in recall as a result of three exposures only for the HOS condition $F(1, 48) = 24.7623$, $p < .01$.

For the Organizational Salience x Cueing interaction the only significant simple main effect was for the Organizational Salience factor on the Cued test $F(1, 48) = 10.1087$, $p < .01$.

Completion Test

Table 4 presents the mean scores on the completion test. The only effect reaching significance was the main effect for Exposures $F(1, 24) = 10.7766$, $p < .01$.

Discussion

In this study the logically sequenced materials produced reliably greater recall than the randomly sequenced materials. However, the significant interactions indicated that this was only for three rather than one exposure, and on a cued rather than an uncued test.

These findings support the view that a complex organizational structure can facilitate recall only after the initial information processing activities associated with normal reading have occurred. During an initial exposure trial Ss are primarily engaged in meaningful processing of the passage on a

Table 4
Mean Recall on Completion Test

Exposures	<u>Organizational Salience</u>		Total
	High	Low	
1	71.57	66.57	69.07
3	101.71	97.00	99.35
Total	86.64	81.78	

sentence by sentence basis. It is only after this initial processing stage has occurred that Ss can begin the elaboration of relationships between sentences which results in the generation of a retrieval scheme for the passage. This evidently takes longer for a prose passage than for a simple word list, where organizational effects emerge after even very brief exposures, because of the complexity of the semantic processing necessary to first understand a sentence and then place it in a meaningful conceptual relationship to the others in the passage.

It is also necessary to present the sentences in a way which permits discovery of the inherent organization. Apparently the sentence by sentence presentation in Experiment I was ineffective in this regard, despite the fact that there were three exposures of the passage.

The nature of the differences between cued and uncued recall was somewhat surprising but can probably be explained in terms of the effects of subjective organization for Ss in the LOS condition. It has been found that retrieval cues must be stored along with the to-be-recalled material in order to be effective (Thompson & Tulving, 1970; Tulving & Osler, 1968; Wood, 1967). To the extent that Ss in the LOS condition organized what they read in some manner different from the inherent logical structure from which the category cues were derived, they would have difficulty using these cues in recall. In fact, the data indicate that the cues actually interfered with recall for these Ss.

As predicted, there were no significant differences in performance on the completion test as a function of organization. Only the number of exposures made a difference. This confirms the findings of Kissler and Lloyd (1973) and supports the view that organizational variables only have effects when the

performance requirements call for retrieval of relatively large amounts of information. The failure of Brunning (1970) to find organizational effects with a completion test can apparently be explained in this way.

General Discussion

This research serves to clarify a number of questions regarding the effects of prose organization. First, it is quite evident that sophisticated users of language have a robust capacity for reorganizing materials which have been presented in an unorganized fashion. Because of this, it is extremely difficult to show an effect for a variable such as that called Organizational Salience in this study. It appears to be necessary to give an extensive exposure to the materials before the organizational variable "takes hold" for those individuals in the conditions which should theoretically produce the largest beneficial effects. This may mean that before the effects of organizational characteristics of prose can be adequately studied, the experimental paradigm will have to involve materials of greater complexity and treatments of longer duration than in previous research.

Taken at face value, the implication of this research is that if there is an inherent conceptual structure in the materials, then a lot of time worrying about sequences, hierarchies, advance organizers, and the like, is unwarranted. It is, of course, quite unlikely that anyone would ever present instructional materials in a random fashion, and within the limits of the normal organizational structure of prose, the benefits from such endeavors appear to be limited. More than a decade of research on sequencing effects in programmed instruction also supports this conclusion (Niedemeyer, 1968).

Because this conclusion is both counter-intuitive and contradicts a substantial amount of basic research and theory, it is imperative that work continue to clarify the relationships involved.

In this study organization was manipulated as a stimulus characteristic, and as such there was no attempt to directly influence the information processing strategies employed by Ss. It is quite possible that these will have to be taken into account before the potential retrieval benefits of a complex prose structure can become effective. Perhaps it is necessary to point structure out explicitly and/or instruct Ss in how to use it to enhance retention. In the long run this may prove to be the most important variable in determining performance.

The failure to find support for advance organizer theory (Ausubel, 1960) in this study suggests that previous positive findings may be the result of the fact that additional information was given, rather than that it provided "ideational scaffolding" for the Ss. Certainly the superordinate structure of the Himoot passage fits within the definition of an advance organizer, but the only reliable effects associated with its manipulation were negative rather than positive. Apparently, where content is constant and only position varies, advance organizers are ineffective or even detrimental. These findings coupled with those of Jenkins and Bausell (1973) who also found advance organizers to be of very limited value calls the whole idea into question.

The finding that cueing interfered with recall for Ss who read unorganized materials has implications for test design in education. If individuals have been encouraged, or required, to adopt an idiosyncratic organization for material which they have learned, then a test design founded upon some other

organizational basis will interfere with performance. This suggests that students should either be informed of the organizational basis for a recall test prior to learning the materials, or the test should be open-ended enough to accommodate a variety of organizational patterns. Otherwise, students who have formed an idiosyncratic cognitive structure may be unfairly penalized.

The efficacy of the multiple exposure condition in Experiment I when compared to a single exposure condition suggests an important procedure for controlling the mathemagenic processes of students. If the interpretation of these data is correct, students would benefit more from several rapid and redundant presentations of the to-be-learned materials than from a single slower presentation, even when total time is equivalent. In education such a procedure could easily be operationalized with computer-assisted instruction, compressed speech tapes and instructional television, for example. The effect is similar to that for massed vs. distributed practice, although both the treatments employed in this study were technically massed practice conditions. Nevertheless, there were substantial learning differences produced by this manipulation which should be investigated with real educational materials.

An additional problem should be considered in future research on organization with prose. Thus far, most research in this area has employed an immediate-test paradigm. It is conceivable that organizational variables are more powerful over a longer retention interval. Montague (1972), for instance, reviewed evidence that long-term memory was better for paired associates for which natural language mediators had been formed. This may also be the case for prose learning involving different organizational patterns. Future research should consider this possibility.

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